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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003906594 for a patent by CROCODILE CORPORATION LTD as filed on 28 November 2003.



WITNESS my hand this
Fourteenth day of December 2004

A handwritten signature in ink, appearing to be 'L. Mynott'.

LEANNE MYNOTT
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Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: "Tyre"

The invention is described in the following statement:

Title

Tyre

Technical Field

This invention relates to a tyre, and more particularly to a tyre having provision
5 for attachment to a wheel rim.

Background of the Invention

A tyre is typically pneumatic or non-pneumatic in form. Whilst pneumatic tyres are more common and widespread than non-pneumatic tyres, they are prone to punctures, a problem not inherent with a solid non-pneumatic tyre.

10 A tyre is required to be firmly fitted onto a rim in order to avoid slippage with respect to the rim when under tractive or breaking loads. There have been various proposals for securing tyres onto wheel rims.

Pneumatic tyres typically have tyre beads which incorporate reinforcing wires and which are stretched over a retaining lip on the wheel rim. Split rim structures
15 are also be used.

With non-pneumatic tyres, there are various arrangements for fitting tyres onto rims. One arrangement involves a so-called conical base tyre adapted to be clamped between a split rim. In another arrangement, the tyre incorporates a steel band at its radially inner end which is pressed onto a rim to provide a
20 so-called "pressed-on" tyre.

Non-pneumatic tyres typically require dedicated wheel rims onto which they can be fitted. Unlike pneumatic tyres where numerous rims are available for fitment thereto, non-pneumatic tyres have the cost disadvantage associated with the manufacture of a dedicated rim. The need to provide dedicated wheel rims limits

the appeal of non-pneumatic tyres and increases the cost of fitting them onto vehicles previously fitted with pneumatic tyres. Accordingly, there is a need for a non-pneumatic tyre which can be fitted onto a conventional wheel rim designed for a pneumatic tyre. A conventional wheel rim for a pneumatic tyre has a tyre support surface incorporating a bead seat on each side of the rim adjacent the rim edge. Each seat comprises an inner seat portion and an outer seat portion. The inner seat portion is inclined inwardly towards the axis of rotation of the wheel rim. The outer seat portion is upstanding with respect to the inner seat portion and terminates in an arcuate portion which defines the outer periphery of the wheel rim.

Fitment of a non-pneumatic (solid rubber) tyre onto a wheel rim designed for pneumatic tyres is usually not contemplated, as it is perceived that a portion of the solid rubber tyre would need to locate in the well of the wheel rim in order for the tyre to be supported properly. This would then make fitting and removal of the tyre very difficult, if not impossible.

Further, fitment of a tyre, whether pneumatic or non-pneumatic, onto a conventional rim designed for pneumatic tyres would, as a matter of routine, call for the services of an experienced tyre fitter, and possibly also a crane where larger tyres are involved. However, tyre fitters, as well as cranes, are not always readily available. This is particularly so at locations where vehicles fitted with non-pneumatic tyres are often used, as such industrial sites and remote areas.

It would be advantageous for there to be a non-pneumatic tyre which can be readily fitted onto a conventional rim designed for pneumatic tyres, using relatively simple mechanical procedures, without the need for the services of an experienced tyre fitter.

Summary of the Invention

According to one aspect of the present invention there is provided a tyre adapted to be fitted onto a wheel rim designed for pneumatic tyres, the wheel rim having a tyre support surface incorporating a bead seat on each side of the rim, each

bead seat comprising an inner seat portion and an outer seat portion terminating in an arcuate portion defining the outer periphery of the wheel rim, the tyre comprising a radially inner portion engagable with the wheel rim, the radially inner portion comprising a rigid band adapted to be supportingly received on, and
5 releasably fixed with respect to, the outer periphery of the wheel rim.

The rigid band may be releasably fixed with respect to the outer periphery of the wheel rim in any appropriate way.

Conveniently, the rigid band comprises a metal band and is releasably fixed with respect to the outer periphery of the wheel rim by being welded thereto. The
10 welding may comprise stitch welding at circumferentially spaced intervals around the band. The band may be welded to either one or both of the arcuate portions defining the outer periphery of the wheel rim. There is an advantage in welding the band only to the particular arcuate portion on the outer side of the wheel rim, as it would allow the tyre to be removed and replaced without the need to
15 remove the wheel rim from the vehicle from which it is fitted.

This fixing arrangement is advantageous, as it is simple yet highly effective. The fitting process simply involves positioning the tyre onto the wheel rim and then welding the band thereto. For removal of the tyre, all that is necessary is to remove the welded bond, typically by grinding off the welds, and then withdraw
20 the tyre from the rim. In this way, the tyre can be fitted and removed without the need for the services of an experienced tyre fitter. All that is required is access to welding equipment and an ability to weld.

It is believed that the welding would not damage the wheel rim to an extent that would preclude use of the wheel rim for its originally intended purpose of
25 receiving a pneumatic tyre, should that be required at some later stage.

While welding is a particularly convenient and effective way of releasably fixing the tyre to the wheel rim, other ways of fixing are also possible, as alluded to above. For example, the rigid band may be bolted or otherwise mechanically fixed to the wheel rim. Bolting would, of course, require the provision of

appropriate bolt holes in the band, and also that corresponding bolt holes be drilled into the wheel rim. In the event that the wheel rim was subsequently required for use with pneumatic tyres, all that would be necessary would be to plug the holes that had been drilled.

- 5 The rigid band is preferably continuous. However, the rigid band can also be discontinuous, in that it may have a gap formed therein to provide a split band, or alternatively there may be a plurality of gaps in circumferentially spaced relation to provide a segmented band. The tyre may be manufactured with the band in a continuous form, and the or each gap formed at some later stage, such as during
- 10 fitting of the tyre.

The tyre may further comprise a cushioning structure.

- The cushioning structure may comprise a body of resiliently deformable material such as rubber bonded onto the band. The band provides a rigid base for supporting the body of resiliently deformable material. In this way, the body of
- 15 resiliently deformable material does not extend into the well of the wheel rim, for otherwise fitting and removal of the tyre would be difficult.

The body may have a plurality of cavities separated by load-supporting walls. This enhances to deformation characteristics of the tyre and provides for weight reduction.

- 20 The body of resiliently deformable material may comprise a unitary mass, or alternatively it may be of composite construction involving, for example, several layers of material having different characteristics. In one arrangement, the composite construction may comprise an inner layer of higher resilience for cushioning and an outer layer which is harder and more durable to provide good
- 25 wear characteristics. The outer layer may also have the ability to be re-treaded.

According to a second aspect of the invention there is provided a combination of tyre according to the first aspect of the invention and a wheel rim having a tyre support surface incorporating a bead seat on each side of the rim, each bead

seat comprising an inner seat portion and an outer seat portion terminating in an arcuate portion defining the outer periphery of the wheel rim, the rigid band being supportingly received on, and releasably fixed with respect to, the outer periphery of the wheel rim.

- 5 Whilst the invention as described herein before has been concerned with non-pneumatic tyres, it could also be applicable to pneumatic tyres.

Brief Description of the Drawings

The invention will be better understood by reference to the following description of several specific embodiments thereof as shown in the accompanying drawings

10 in which:

Figure 1 is a perspective view of a tyre according to a first embodiment of the invention;

Figure 2 is a side view of the tyre according to the first embodiment;

15 Figure 3 is a half cross-sectional view of the tyre according to the first embodiment; and

Figure 4 is a half cross-sectional view of the tyre according to a second embodiment.

Best Mode(s) for Carrying out the Invention

Referring now to Figures 1 to 3 of the accompanying drawings, there is shown a
20 non-pneumatic tyre 10 according to a first embodiment. The tyre 10 is adapted to be fitted onto a conventional wheel rim 13 designed for pneumatic tyres. The wheel rim 13 has a tyre support surface 15 incorporating a seat 17 on each side of the rim adjacent the rim edge 18. Each seat 17 comprises an inner seat portion 19, and an outer seat portion 21 terminating in an arcuate portion 22
25 defining the outer periphery of the wheel rim. The inner seat portion 19 is

inclined inwardly towards the axis of rotation of the wheel rim, and the outer seat portion 21 is upstanding with respect to the inner seat portion. As mentioned, the wheel rim 13 is of conventional construction and is designed to accommodate a pneumatic tyre.

- 5 It is a particular feature of the tyre 10 according to this embodiment that it can be fitted onto a standard rim for pneumatic tyres and does not require a dedicated rim structure as is typically the case for previously known non-pneumatic tyres.

The tyre 10 has a radially inner portion 31, a radially outer portion 32 incorporating a tread structure 40, and an intermediate portion 33 extending
10 between the radially inner and outer portions to provide cushioning. The tyre 10 also has a central opening 34 and opposed sides 36. The intermediate portion 33 comprises a multitude of holes 35 opening onto opposed sides of the tyre. The holes 35 do not extend entirely through the body 30 and so holes opening
15 on to one side of the tyre are separated from holes opening onto the other side of the tyre by a central circumferential load supporting wall 37. Holes 35 on the same side of the tyre are separated by load supporting walls 39. The load supporting walls 37, 39 extend radially with respect to the tyre and and flex under load to provide cushioning .

The radially inner portion 31 of the tyre is defined a rigid band 41 which is formed
20 of metal . A body 43 of resiliently deformable material such as rubber bonded onto the band 41. The body 43 provides the radially outer portion 32 incorporating tread structure 40, and also the intermediate portion 33 extending between the radially inner and outer portions to provide the cushioning.

As can be best seen in Figure 3 of the drawings, the body 43 extends laterally
25 beyond the rigid band 41 at the radially outer portion 32 thereof, to provide an overhang 44 on each side of the tyre.

The rigid band 41 is internally sized so that it can be positioned around the wheel rim 13, with the rigid band being supportingly received on the outer periphery of the wheel rim, as best seen in Figure 3. More particularly, the inner surface 42 of

the rigid band locates on the outer periphery of the wheel rim defined by the two arcuate portions 22.

The band 41 thus provides a rigid base for supporting the body 43, including in particular the load supporting walls 37, 39.

- 5 The rigid band 41 is releasably fixed with respect to the outer periphery of the wheel rim 13 by being welded thereto. In this embodiment, the rigid band 41 is welded to either or both of the arcuate portions 22 by a series of stitch welds 45, as illustrated in Figure 2 of the drawings. The stitch welds 45 provide a simple yet highly effective way of fixing the tyre 10 to the wheel rim 13.
- 10 The fitting process simply involves positioning the tyre 10 onto the wheel rim 13 and then welding the rigid band 41 to the outer periphery of the wheel rim. Positioning of the tyre onto the wheel rim is a simple procedure, as the rigid band 41 is sized to fit onto the outer periphery of the wheel rim 13. For subsequent removal of the tyre 10 from the wheel rim 13, all that is necessary is to grind off
- 15 the stitch welds 45 so that the tyre can be withdrawn from the wheel rim.

The second embodiment, which is shown in Figure 4 of the drawings, is similar to the first embodiment and so corresponding reference numerals are employed to identify similar parts. However, in the second embodiment, the overhang 44 to one side of the tyre is greater than that on the other side of the tyre, as can be

20 seen in the drawing.

From the foregoing, it is evident that the two embodiments each provide a tyre which is of relatively simple construction and which can be simply fitted onto a conventional wheel rim designed for pneumatic tyres. This is particularly advantageous, as it avoids the need for a dedicated wheel rim which would

25 otherwise limit the appeal of the non-pneumatic tyres, as well as increasing the cost of fitting them onto vehicles previously fitted with pneumatic tyres.

It is a particular feature of the embodiments that the tyre 10 can be fitted to, and removed from, the wheel rim without the need for the services of an experienced

tyre fitter. All that is required is access to welding equipment and an ability to weld.

It should be appreciated that the scope of the invention is not limited to the scope of the two embodiments described. For example, the rigid band need not
5 necessarily be fixed to the wheel rim by way of welding. The rigid band may be bolted or otherwise mechanically fixed to the wheel rim.

Improvements and modifications may be incorporated without departing from the scope of the invention.

Throughout the specification, unless the context requires otherwise, the word
10 "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

15 Dated this Twenty Eighth day of November 2003.

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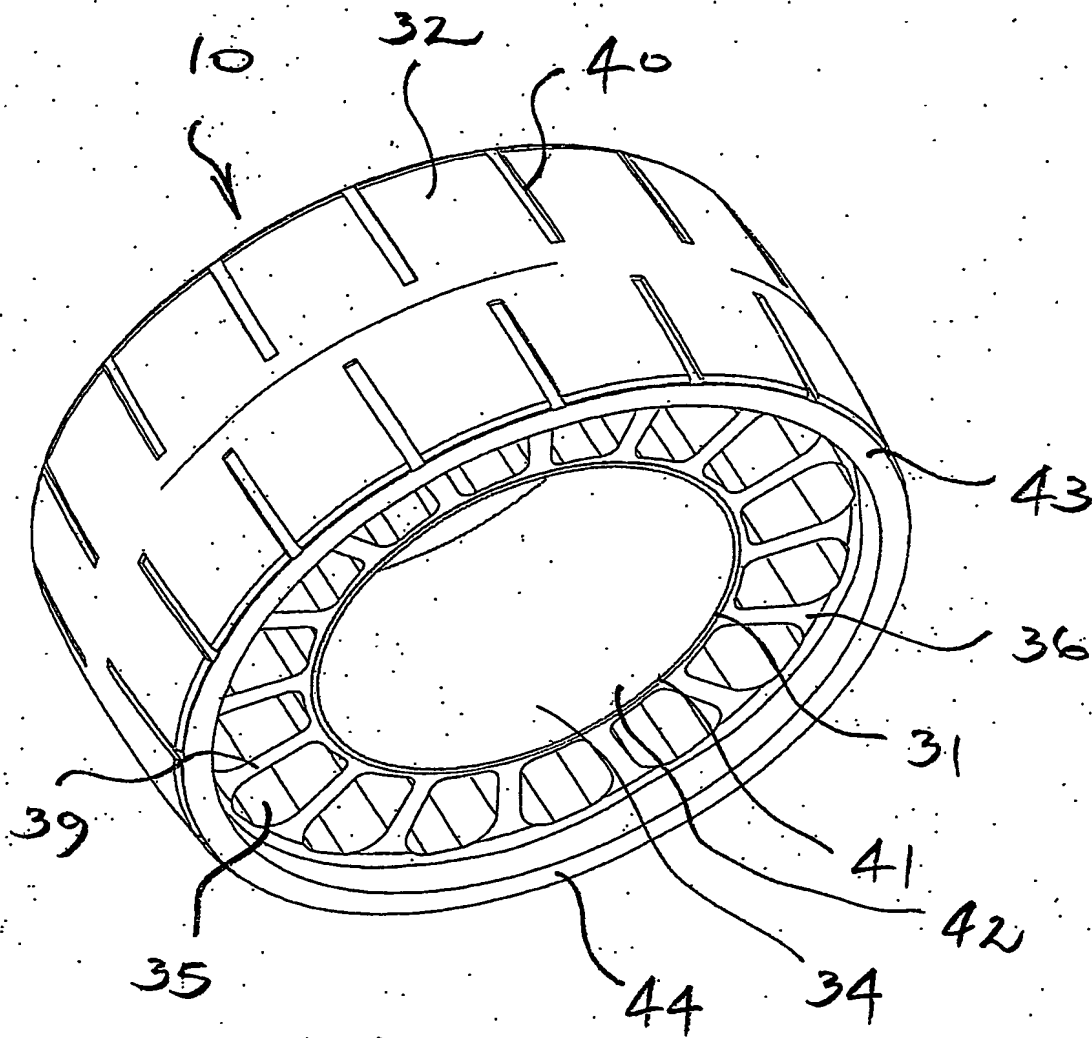
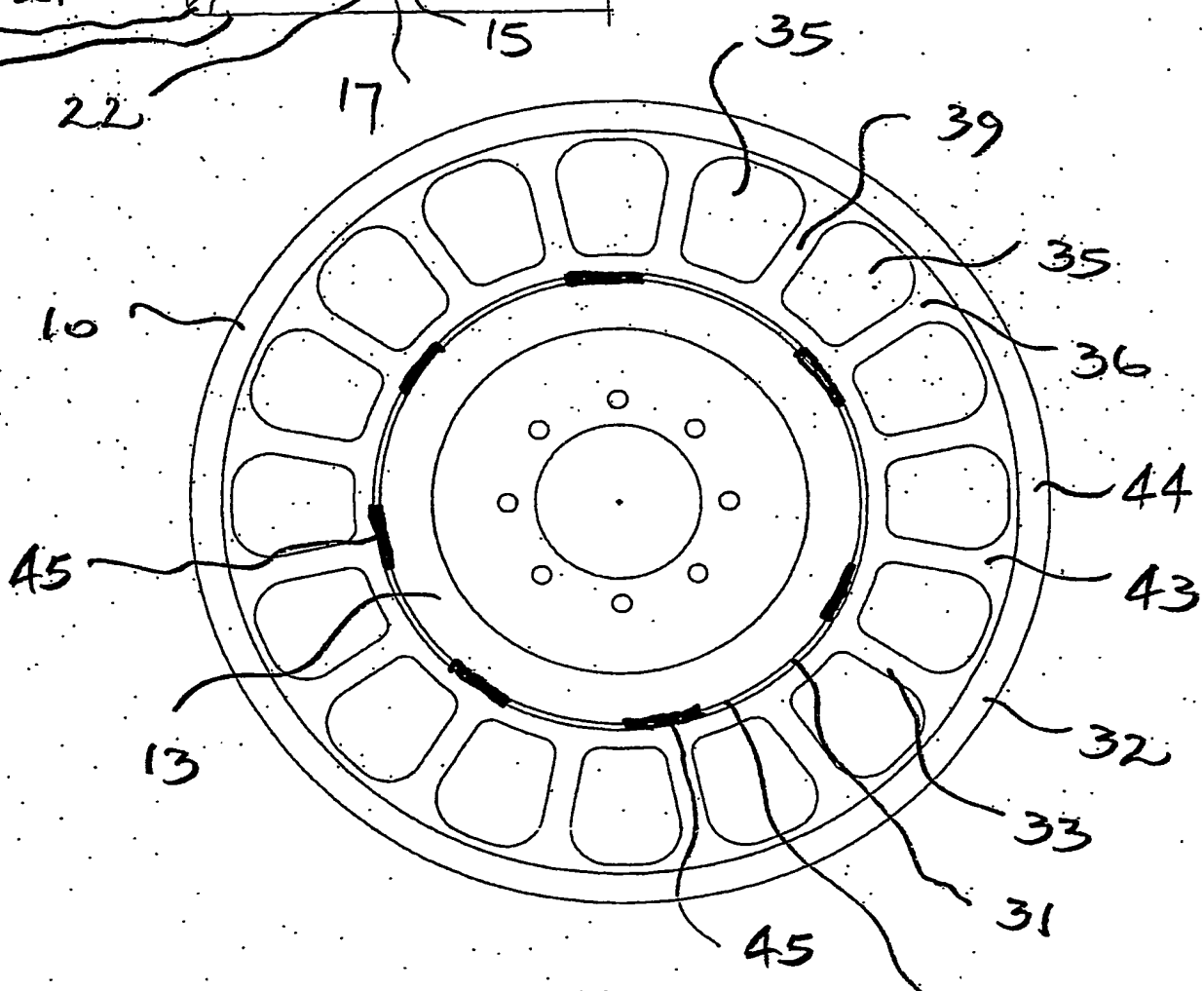
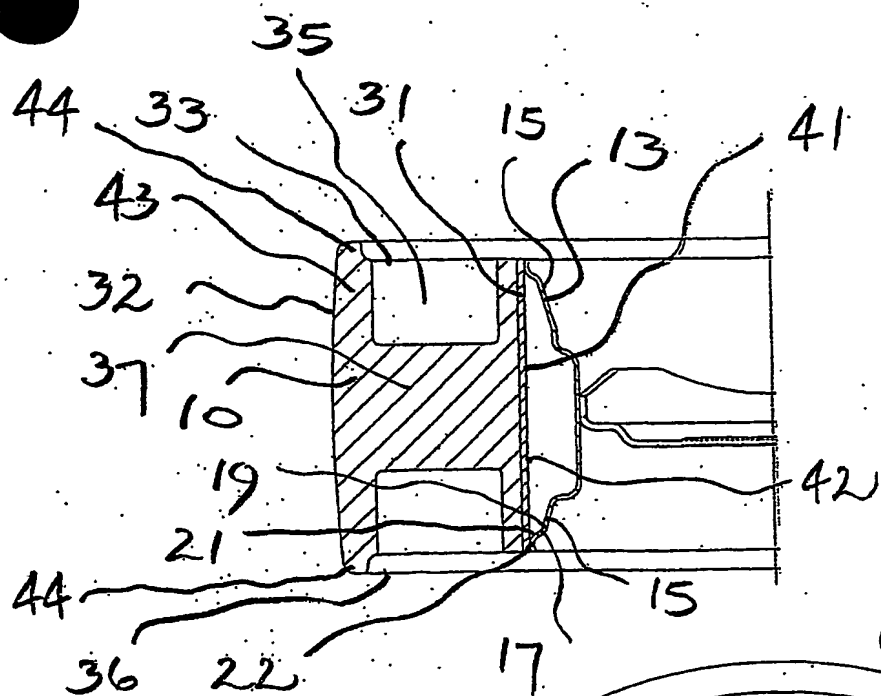


FIG. 1



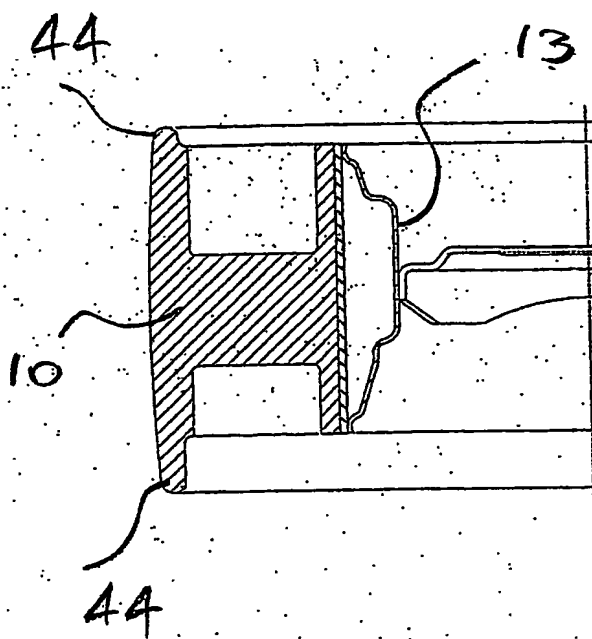


FIG. 4

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